Specialty Conference

Fever and Pulmonary Infiltrates in a Patient With a Renal Transplant

Discussants

JAN V. HIRSCHMANN, MD; JAMES J. PLORDE, MD, *and* REX F. OCHI, MD

This discussion was selected from the weekly Grand Rounds in the Department of Medicine, University of Washington, Seattle. Taken from a transcription, it has been edited by Drs Paul G. Ramsey, Assistant Professor of Medicine, and Philip J. Fialkow, Professor and Chairman of the Department of Medicine.

REX F. OCHI, MD:* A 42-year-old man was admitted to hospital in April 1983 because of cough, wheezing, abdominal pain and rectal bleeding. In November 1981 he had undergone successful cadaveric renal transplantation for chronic renal failure due to glomerulonephritis. Following transplantation, the serum creatinine level was about 2.9 mg per dl on immunosuppressive therapy consisting of prednisone, 25 mg a day, and azathioprine, 125 mg a day. Wheezing first developed in early March 1983 and the serum creatinine level was found to be 8.3 mg per dl. The patient was treated for transplant rejection with temporary hemodialysis, prednisone, 200 mg a day, and azathioprine, 150 mg a day. After the serum creatinine level fell to 4.0 mg per dl, the dosage of immunosuppressive agents was rapidly tapered over three weeks to prednisone, 80 mg a day, and azathioprine, 100 mg a day. In late March, multiple cutaneous abscesses developed around the right eye, left flank, umbilicus and groin, for which he was given cephalexin monohydrate, 500 mg by mouth four times a day. His prednisone dosage was tapered to 60 mg per day.

In early April the patient had increasing wheezing, dyspnea and purulent sputum. He also noted hematochezia and abdominal pain exacerbated by medication and relieved by meals or antacids. There was no history of allergies, fever, melena or the use of alcoholic beverages or aspirin.

The patient spent the first 12 years of life in Samoa and then lived in San Francisco until 1982. At that time he moved to Seattle where he worked as a furniture upholsterer. The patient's mother died of glomerulonephritis; his brother, still living in Samoa, has "kidney disease." Medication at the time of admission included prednisone, azathioprine, furosemide and a long-acting theophylline preparation.

On physical examination the temperature was 37.2°C, pulse 96 beats per minute, respirations 22, blood pressure 132/90 mm of mercury and weight 93.2 kg (down 2 kg from usual). The patient appeared cushingoid but otherwise well except for mild respiratory distress. There were diffuse expiratory and inspiratory wheezes, the abdomen was minimally tender in the subxyphoid region and there were several 0.5-cm furuncles on the back and perianal area. On rectal examination there were small amounts of bright red blood. There was no peripheral edema, and the remainder of the physical examination showed no abnormalities.

Arterial blood gas determinations done while the patient was receiving two liters of oxygen by nasal prongs gave the following values: pH 7.41, carbon dioxide partial pressure (P_{CO_2}) 32 mm of mercury, oxygen partial pressure (P_{O_2}) 135 mm of mercury and bicarbonate 20 mEq per liter. The hematocrit was 18% with moderate polychromasia and normal erythrocyte indices. The leukocyte count was 11,200 per μl with 5,820 neutrophils, 2,640 bands, 1,100 lymphocytes, 550 metamyelocytes, 220 myelocytes, 2 nucleated erythrocytes and no eosinophils or basophils. Serum electrolytes in mEq per liter were as follows: sodium 131, potassium 3.6, chloride 100 and carbon dioxide 22.

*Medical resident, Department of Medicine, University of Washington School of Medicine.

(Hirschmann JV, Plorde JJ, Ochi RF: Fever and pulmonary infiltrates in a patient with a renal transplant—University of Washington [Specialty Conference]. West J Med 1984 Jun; 140:914-920)

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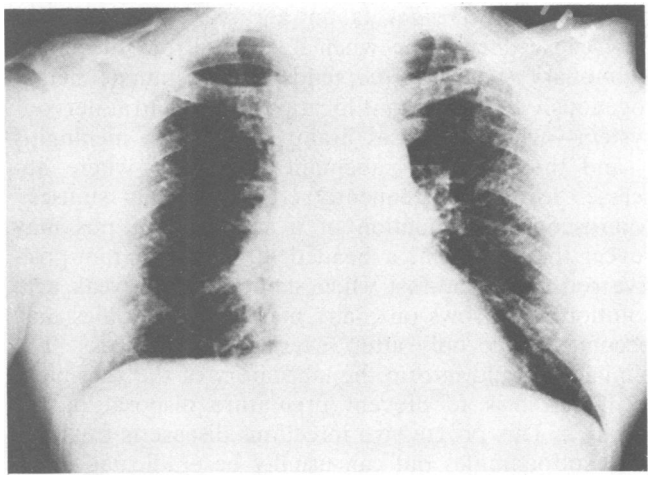

Figure 1.—Chest roentgenogram showing diffuse interstitial infiltrates.

Other serum chemistry values included creatinine 5.1, calcium 9.1, phosphorus 4.3 and urea nitrogen 90 mg per dl. The albumin was 3.1 grams per dl, alkaline phosphatase 60 IU per liter and theophylline concentration less than 2.5 μg per ml. Sputum Gram's stain showed moderate neutrophils with mixed flora and many Gram-negative coccobacillary forms. Chest x-ray film showed no abnormalities. Nasogastric aspirate was guaiac-negative. Initial treatment included intravenous administration of aminophylline (theophylline 85% with ethylenediamine 15%), methylprednisolone, cephalothin sodium, cimetidine and two units of packed erythrocytes.

On hospital day 2 anoscopy and sigmoidoscopy showed a left lateral dilated hemorrhoid with superficial bright red blood from erosions. Methylprednisolone therapy was discontinued and prednisone therapy begun. On hospital day 3 the patient's epigastric pain was diminished and a barium enema study showed no abnormalities except for diverticulosis. On hospital day 5 the patient had worsening of chest and abdominal pain, and an upper gastrointestinal series showed a 6-mm duodenal ulcer. Antacids were added to the medical regimen. Arterial blood gas determinations done while the patient was breathing room air showed a Po_2 of 51 mm of mercury, the serum creatinine level was 6.3 mg per dl and a chest x-ray film showed changes typical of volume overload. He underwent hemodialysis with a dramatic reduction in symptoms. A sputum culture from admission grew *Hemophilus influenzae,* and the antibiotic therapy was changed to ampicillin.

On hospital day 6 the patient felt better but still had bilateral wheezing on chest examination and a mildly tender abdomen. The leukocyte count was 10,900 per μl with 7,740 neutrophils, 1,960 bands, 550 lymphocytes, 330 monocytes, 110 eosinophils, 110 metamyelocytes and 110 myelocytes. The serum amylase level was 190 IU per liter. On hospital day 7 the patient's creatinine level was 7.2 mg per dl and hemodialysis was repeated.

TABLE 1.—*Active Medical Problems in a Patient Who Has Had a Renal Transplant*

Multiple cutaneous abscesses	Duodenal ulcer
Wheezing, dyspnea, hypoxia	Diverticulosis
Gastrointestinal hemorrhage	Increased serum amylase
Abdominal pain	Fever
Anemia	Purulent, bloody sputum
Leukoerythroblastosis	Diffuse pulmonary infiltrates
Hypoalbuminemia	Gram-negative rods in blood and sputum

On hospital day 8 the patient's abdominal pain increased and his cough became productive of purulent blood-tinged sputum. His temperature was 39°C and weight 87.7 kg; a chest x-ray film showed diffuse interstitial infiltrates (Figure 1). A sputum Gram's stain showed 3+ neutrophils and 4+ Gram-negative rods. The antibiotic regimen was changed to cephalothin, tobramycin and trimethoprim-sulfamethoxazole (Cotrimoxazole).

On hospital day 9 the patient remained febrile and a Gram-negative rod grew from cultures of sputum and blood specimens. Further diagnostic studies were done.

Discussion

JAN V. HIRSCHMANN, MD:* Confronted with such a complex and puzzling case, I feel like the person who asked Fats Waller what jazz is. "Man, if you don't *know* what it is, don't mess with it," Waller answered. Wise counsel, but as Oscar Wilde said, there is only one thing to do with good advice—pass it along. Having done that, I'll now discuss the patient's illness.

In analyzing a complicated case, the best starting point is to list the identifying data and the current medical problems. The patient is a 42-year-old man who lived in Samoa until age 12. His residence in a tropical country 30 years ago may become crucial in the differential diagnosis. The other important history is the cadaveric renal transplant for chronic glomerulonephritis 1½ years ago, for which he received varying doses of immunosuppressive drugs, prednisone and azathioprine. The patient's present illness involves at least 14 problems (Table 1). In tabulating these, one should keep the possibly related conditions separate unless there is cogent evidence that they constitute a single diagnosis. For example, it is tempting to attribute the gastrointestinal hemorrhage to the duodenal ulcer, but the absence of blood in the nasogastric aspirate and the lack of melena make an upper intestinal tract source uncertain. Similarly, the fever, purulent sputum, diffuse pulmonary infiltrates and growth of Gram-negative rods in the blood and sputum specimens seem to indicate a pneumonia caused by enteric Gram-negative rods. The radiographic appearance of a mixed alveolar-interstitial pattern affecting the entire lung, including the apices, however, is very unusual for an uncomplicated Gram-negative

*Associate Professor, Department of Medicine, University of Washington School of Medicine.

TABLE 2.—*Systemic Infections Causing Skin Lesions in Immunodeficient Hosts*

Organisms	
Higher Forms of Bacteria	Viruses
Nocardia	Herpes simplex
Mycobacteria	Varicella-zoster
Fungi	Parasites
Candida	*Strongyloides stercoralis*
Cryptococcus neoformans	
Aspergillus sps	
Histoplasma capsulatum	
Coccidioides immitis	

bacillary pneumonia, and these features should initially be considered as separate entities.

The next step is to choose two or three prominent or distinctive features in the case, generate a differential diagnosis for each and determine whether the disorders listed can explain the patient's illness. I have chosen for discussion the cutaneous abscesses and pustules, the leukoerythroblastosis and the diffuse pulmonary infiltrates.

Before proceeding, however, one must acknowledge a methodologic and conceptual concern, well illustrated by two similes that Bertrand Russell proposed when asked to contrast his philosophy with Alfred North Whitehead's.[1(p62)] Russell said that he considered the world to be like a heap of shot, but that Whitehead saw it as a bowl of treacle. Russell viewed reality as multiple discrete entities; Whitehead, the great proponent of organic unity, saw homogeneity even among apparently disparate matter. The question in this patient is whether his current illness is a heap of shot or a bowl of treacle—several diseases or diverse manifestations of a single disorder. Ordinarily in differential diagnosis, especially in clinicopathologic correlations, the clinician heeds the guidance of a 14th century English monk, William of Ockham (1300 to 1349), who enunciated the principle called Ockham's razor: "Entities are not to be multiplied beyond necessity." If one disease explains everything, why invoke more? This dictum is usually appropriate with children and young adults, but as patients age or become immunocompromised, the concurrence of several diseases is frequent and the use of Ockham's razor can be misleading.

The patient's problem of multiple pustules is a good example. These may be nothing more than staphylococcal pyoderma or the nonspecific acneiform lesions common to patients receiving high-dose corticosteroids. The cutaneous manifestations of systemic infections in immunodeficient hosts, however, may appear trivial, emphasizing the importance of promptly obtaining specimens for culture, Gram's stains and biopsy specimens from persistent or peculiar skin abnormalities.[2] Disseminated infections caused by a variety of organisms, including bacteria, fungi, viruses and parasites, may produce skin lesions in renal transplant recipients or other patients with severely impaired cell-mediated immunity (Table 2).

Nocardia asteroides is an aerobic bacterium that may cause pneumonia when inhaled. From the initial pulmonary site *Nocardia* tends to disseminate hematogenously to two distant locations: the central nervous system—where it causes brain abscesses or meningitis —and the skin and subcutaneous tissue—where abscesses form that frequently create draining sinuses.[3] Microscopic examination of a specimen of pus may reveal the organism, a beaded, branching Gram-positive rod. It is acid-fast when stained with a weak acid solution and grows on many media, but colonies may become visible only after several days to weeks. The clinician should inform the laboratory of the possibility of nocardiosis to prevent premature disposal of the cultures. This progressive infectious disease is treatable with sulfonamides but can usually be eradicated in an immunocompromised host only with protracted therapy for at least 6 to 12 months. Co-trimoxazole (sulfamethoxazole-trimethoprim) may be the most effective antimicrobial agent.[4] Although nocardiosis could explain the pustules and cutaneous abscesses seen in the patient, this infection rarely involves the gastrointestinal tract, and the abnormality seen on chest x-ray film is typically a segmental infiltrate or multiple nodules rather than a diffuse, mixed alveolar-interstitial pattern.[5] Furthermore, there is no unique association with Gram-negative bacteremia.

Tuberculous or nontuberculous ("atypical") mycobacteria can cause skin lesions, most often nodules that ulcerate, but also abscesses or pustules.[6] Disseminated infections with nontuberculous mycobacteria, particularly *Mycobacterium chelonei* and *Mycobacterium haemophilum,* cause cutaneous lesions in renal transplant recipients.[7] These infections, however, rarely involve the gastrointestinal tract or the lungs, and there is no association with Gram-negative bacteremia. *Mycobacterium tuberculosis* can affect the alimentary canal, typically in the terminal ileum, where perforations may lead to Gram-negative bacteremia. The chest roentgenographic pattern of mixed alveolar-interstitial infiltrates is sometimes seen, but this appearance typically represents bronchogenic spread of a preceding cavitary lesion. This patient's admission chest film, however, showed no abnormalities. While hematogenous spread of tuberculosis to the lungs from a gastrointestinal site could occur, the radiographic pattern should be miliary, with multiple tiny nodules, not a mixed interstitial-alveolar infiltrate. Furthermore, cutaneous involvement with *M tuberculosis* is uncommon, even in an immunocompromised patient. For this case to be tuberculosis would involve more coincidences than in a Dickens novel.

The cutaneous lesions of systemic candidiasis are usually single or multiple erythematous papules or nodules rather than pustules, because the blood-borne organisms lodge in the dermis rather than the epidermis. Blood cultures are usually positive, typically for *Candida tropicalis,* and patients characteristically have cancer and neutropenia.[8] *Candida* may involve the gastrointestinal tract, usually as esophagitis (not clin-

ically evident in this case), but also as ulcerations in the stomach, small intestine and colon.[9] Because *Candida* rarely causes significant pulmonary disease[10] and commonly accompanies other infections, its typical roentgenographic appearance is uncertain, but the organisms should be found in a sputum Gram's stain and culture.[11] Systemic candidiasis usually develops in patients receiving extensive antimicrobial chemotherapy, especially while they are neutropenic. In this patient, therefore, disseminated candidiasis seems unlikely.

Cryptococcus neoformans most commonly causes nodular skin lesions, which may ulcerate, or areas of cutaneous erythema, warmth and tenderness resembling bacterial cellulitis. Abscesses, plaques, pustules or acneiform lesions occasionally occur.[12] India ink preparation of a skin aspirate may establish the diagnosis by showing budding yeasts surrounded by a thick polysaccharide capsule. Cryptococcosis is unlikely in this case because this organism rarely involves the gastrointestinal tract and has no particular association with Gram-negative bacteremia. Although pulmonary cryptococcosis may show many different radiographic appearances—focal pneumonia, nodules, masses, miliary pattern—a diffuse mixed alveolar-interstitial form is not among them.[13]

Aspergillus species, usually *Aspergillus flavus,* can cause cutaneous lesions, typically necrotizing skin ulcers with a black eschar,[14] which are usually primary infections. Hematogenous aspergillosis from a pulmonary focus can cause cutaneous abscesses, and the organism commonly affects the gastrointestinal tract, causing ulcerations and hemorrhage.[15] Most patients, though, are neutropenic and have received broad-spectrum antibacterial therapy. Furthermore, Gram-negative bacteremia due to intestinal perforation from an aspergillar ulcer would be unusual. Finally, the typical chest radiographic abnormalities are nodules or segmental infiltrates, often mimicking a pulmonary embolus because of the organism's tendency to invade vessels and cause thrombosis.

There is no epidemiologic information to incriminate histoplasmosis or coccidioidomycosis as this patient has not lived in endemic areas for either. The description of the skin pustules and abscesses makes herpesvirus infections unlikely. Although herpes simplex virus can cause pneumonia in an immunocompromised host, most patients have vesicular mucocutaneous lesions, and most with concomitant bacterial pneumonias have neutropenia.[16] The skin lesions in this patient were not vesicular and did not occur in a dermatomal pattern, excluding herpes zoster as well. A parasite that can cause cutaneous lesions, *Strongyloides stercoralis,* will be discussed later.

The second feature of this patient's illness is leukoerythroblastosis, the presence on the peripheral blood smear of nucleated erythrocytes and immature neutrophils ordinarily seen only in the bone marrow. In three studies comprising nearly 300 patients many causes of leukoerythroblastosis were found (Table 3).[17-19] The most frequent underlying mechanism is bone marrow infiltration by malignant cells or abnormal stem cells related to the myeloproliferative disorders, such as myeloid metaplasia or polycythemia vera. There is no evidence of these diseases in this patient. Although leukemia is associated with Gram-negative bacteremia and hemorrhage, these usually occur from neutropenia and thrombocytopenia, respectively, neither being present in this case. An occult malignant disorder is possible, especially because the impaired immune surveillance associated with renal transplantation enhances the risk of certain neoplasms.[20] The increased incidence of cancer, however, does not include common malignant tumors of the general population, such as of lung, prostate, breast, colorectal or uterine cervix. Prostate cancer and breast cancer, in fact, are the malignant disorders most likely to cause leukoerythroblastosis. Skin cancer, mainly squamous cell, occurs from 4 to 20 times more frequently in renal transplant recipients than in the general population, but the lesions are localized, easily discerned and readily controlled.

TABLE 3.—*Causes of Leukoerythroblastosis**

Marrow Infiltration	(56%)	Hemolysis	(8%)
Carcinoma	12%	Infections	(7%)
Acute leukemia	11%	Miscellaneous	(29%)
Lymphoma	10%	Gastrointestinal tract hemorrhage	4%
Myeloid metaplasia	8%	Renal transplant	2%
Chronic leukemia	8%		
Preleukemia	3%		
Multiple myeloma	2%		
Polycythemia vera	2%		

*Data were compiled from three clinical studies.[17-19] Numbers in parentheses represent the percent of patients falling into each category.

Lymphomas occur frequently in renal transplant recipients, but do not follow the usual histologic distribution. Whereas Hodgkin's disease ordinarily represents 34% of all lymphomas, it constitutes only 3% of those in renal transplant patients.[20] Non-Hodgkin's lymphomas, however, occur 45 to 100 times more frequently in renal transplant recipients than in the general population. The average patient age is 38, the male-to-female ratio is 2:1 and the mean time following transplantation is 30 months. The patient in the case discussed here received his graft about 16 months before his current illness, which is within the range reported. Of patients with lymphoma 40% have central nervous system involvement, and most other patients have peripheral lymphadenopathy. However, neither was evident in this patient. A lymphoma involving the small bowel and causing bleeding and perforation is possible, but the chest roentgenographic abnormalities would be difficult to explain.

The other malignant disorder whose incidence is increased in renal transplant recipients is Kaposi's sarcoma, which accounts for 3.3% of cases of cancer in this group compared with 0.6% in the general population. About 60% involve the skin or oropharyngeal mucosa only, while 40% affect the viscera, especially the alimentary and respiratory tracts. Skin or oropharyngeal lesions are almost always present, however, typically as reddish-brown or purplish nodules. Their

TABLE 4.—*Pulmonary Infections in Patients With Defective Cellular Immunity*

Organisms	
Bacteria	Viruses
Salmonella	Herpes simplex
Legionella	Varicella-zoster
	Cytomegalovirus
Higher Forms of Bacteria	
Nocardia	Parasites
Mycobacteria	*Pneumocystis carinii*
	Strongyloides stercoralis
Fungi	
Cryptococcus neoformans	
Aspergillus	
Mucor	
Candida	

absence makes this diagnosis unlikely. Because an occult malignant lesion appears improbable, a review of the other causes of leukoerythroblastosis suggests that infection, gastrointestinal hemorrhage or renal transplantation itself might explain the hematologic abnormalities in this patient.

The last area to examine is the presence of diffuse pulmonary infiltrates in this immunocompromised host. In general, it is useful to divide the diagnostic possibilities into four categories: (1) the underlying disease itself; (2) a direct effect of the treatment, either an adverse drug reaction or pneumonitis from radiation therapy; (3) infection, and (4) miscellaneous causes, especially pulmonary hemorrhage, edema or emboli. Pulmonary infection appears obvious, but the roentgenographic pattern makes conventional types of Gram-negative bacillary pneumonia unlikely, as they are usually focal processes, even in an immunodeficient host. There are three possible explanations for the concurrence of the Gram-negative rods in both blood and sputum: (1) the bacteremia arises outside the lung, the pulmonary process is unrelated and the organism's presence in the sputum represents colonization, not infection; (2) the lung is the primary source of the bacteremia, but the organism is unusual; (3) a Gram-negative bacillary pneumonia is superimposed on another pulmonary process. The first possibility seems highly improbable. Among unusual Gram-negative rods, *Salmonella* could explain the gastrointestinal hemorrhage and a concomitant pneumonia. *Salmonella* usually causes a focal infiltrate, however. A miliary pattern has been described,[21] but a mixed interstitial-alveolar appearance rarely, if ever, occurs.

The most likely explanation is a Gram-negative bacillary pneumonia accompanying another infection. The infections to consider are those regulated by cell-mediated immunity (Table 4), most of which have been discussed already. Cytomegalovirus, however, deserves careful scrutiny. It can cause a diffuse mixed alveolar-interstitial pneumonia that is often complicated by Gram-negative superinfections, and it has been isolated from intestinal ulcers that may bleed. Cytomegalovirus pneumonia tends to occur in the first few months after transplantation, however, and bacterial infections typically develop because of the neutropenia that the cytomegalovirus infection often induces.[22] These points make the diagnosis of cytomegalovirus unlikely. *Pneumocystis carinii* can cause a pneumonia like this patient's, but bacterial superinfection is uncommon without neutropenia, and this parasite does not involve the intestinal tract.

The remaining organism to consider, *Strongyloides stercoralis,* provides the best explanation for this patient's illness. A review of the life cycle of this worm will explain how it could persist for 30 years after the patient left an endemic area. *S stercoralis* is present throughout the tropics, where it is free-living in the soil as infective filariform larvae.[23] These larvae enter the skin and, via the lymphatic and venous circulations, migrate to the lung, whence they are expectorated and swallowed. In the upper intestinal tract they mature into adult worms and reproduce to yield noninfective progeny called rhabditiform larvae. These leave the gastrointestinal tract in feces and mature in soil to become the infective filariform larvae. Some rhabditiform larvae transform into the invasive filariform stage while still in the intestinal tract and can then traverse the bowel wall or perianal skin to reinfect the host. This "autoinfection" is especially likely to occur when decreased gastrointestinal motility prolongs the larval transit time in the alimentary canal or abnormalities such as colonic diverticula provide areas of stasis where larvae can mature. Autoinfection is common in normal hosts, allowing the parasite to persist for decades. In a follow-up study of 160 Australian prisoners in Southeast Asia during World War II, 27.5% had *Strongyloides* infection 34 to 37 years after leaving the endemic area.[24]

Autoinfection occurs especially in immunocompromised hosts, primarily in those receiving high-dose systemic corticosteroids. In these patients the larvae can enter the bloodstream in such great numbers that overwhelming strongyloidiasis develops.[25,26] The primary clinical manifestations involve lung, gastrointestinal tract and skin. Larvae in the lung cause dyspnea, cough, wheezing, purulent sputum, hemoptysis and diffuse infiltrates with a mixed alveolar-interstitial pattern. These helminths can cause diarrhea, small and large intestinal tract ulcers that may bleed and upper abdominal pain similar to that of peptic ulcer disease. As the filariform larvae penetrate the skin, usually in the perineal and thigh area, they can cause pustules or a serpiginous lesion known as larva currens, which outlines the larval migration.

About 45% of cases of overwhelming strongyloidiasis are associated with superinfections with enteric bacteria, usually Gram-negative bacilli like *Escherichia coli* and *Klebsiella.* Bacteremia, pneumonia and meningitis, alone or in varying combinations, may occur. Parasitologists have proposed the following three theories to explain the bacteremia: (1) disruptions of the bowel wall allow enteric organisms to enter the bloodstream; (2) the bacteria adhere to the external surfaces of the larvae as they enter the circulation, and

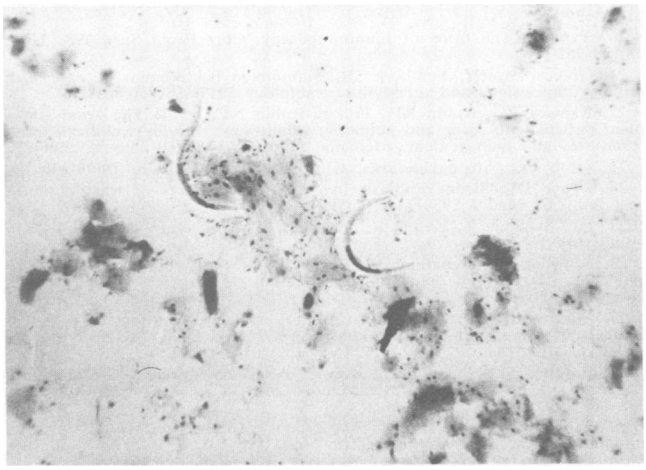

Figure 2.—Sputum cytology specimen examined by light microscopy (reduced from magnification ×40) shows two helminth larvae.

(3) larvae traveling in the bloodstream excrete bacteria from their alimentary canals. The diagnosis of overwhelming strongyloidiasis is established by finding filariform larvae in specimens of sputum, feces or, occasionally, cerebrospinal fluid.[27,28] Although blood eosinophilia is characteristic of strongyloidiasis in a normal host, the eosinophil count is usually normal or reduced in patients with overwhelming disease.

The treatment of this disorder is one of the few cases in medicine where the Mae West approach is appropriate. It was Mae West who said, "Too much of a good thing is . . . wonderful." In the world of helminthology this means more thiabendazole. For immunocompetent hosts, thiabendazole given orally in doses of 25 mg per kg of body weight twice a day for two days cures intestinal *Strongyloides* infestation. Immunosuppressed patients, however, require at least five days of treatment and often much longer before the infection is eradicated.[29] Even with thiabendazole and appropriate therapy of any concomitant bacterial process, however, the death rate for overwhelming strongyloidiasis in compromised hosts is about 40%.[25]

A review of the problem list (Table 1) shows how strongyloidiasis can explain the present patient's illness. The multiple pustules and cutaneous abscesses, especially in the perineal and thigh area, may represent autoinfection with filariform larvae. The gastrointestinal hemorrhage, abdominal pain, anemia and hypoalbuminemia may be due to intestinal ulceration with fecal loss of blood and protein. Although the duodenal ulcer seen on radiographs may have been peptic in origin, it might also be an example of strongyloidal ulceration. The presence of colonic diverticula may have permitted transformation of the larvae from the rhabditiform to the filariform stage, allowing the organism to persist for years. The raised serum amylase level may represent decreased amylase excretion because of renal insufficiency or the unexplained elevation seen in some patients following renal transplantation.[30] Alternatively, however, *Strongyloides* larvae can disseminate hematogenously to the pancreas, where they cause inflammation. The wheezing, dyspnea, fever, purulent sputum, hemoptysis and diffuse pulmonary infiltrates are probably due to larvae in the lung and the complicating Gram-negative pneumonia with bacteremia.

JAMES J. PLORDE, MD:* A cytologist rather than a parasitologist provided the answer to this patient's puzzling illness. With the worsening of the patient's respiratory state, sputum specimens were collected and sent to the pathology department for cytologic examination. Among the normal host cells lay a most unusual structure identified as a helminth larva (Figure 2). This finding led, in search of a more definitive identification, to an examination of the patient's stool specimens. Numerous rhabditiform, or free-feeding, helminth larvae were found. Only one common intestinal helminth, *S stercoralis,* regularly deposits such larvae in feces, making the diagnosis of disseminated strongyloidiasis likely. Occasionally, however, eggs of other helminth species, especially hookworm, if present in a stool specimen and allowed to embryonate for several hours in a warm laboratory, can hatch, releasing larvae morphologically similar to *Strongyloides*. To distinguish between these larvae one must closely inspect the buccal cavity and genital primordium of the worm in question. The hookworm larvae have a larger buccal cavity and a smaller genital primordium. The larvae found in the stool specimen of this patient had a short buccal cavity and large genital primordium, establishing them as *Strongyloides* larvae.

As Dr Hirschmann mentioned in his discussion, disseminated strongyloidiasis occurs when the noninvasive rhabditiform larvae generally found in feces molt into the larger and invasive filariform stage. Thus, the diagnosis of disseminated strongyloidiasis usually rests with the finding of the forked-tail filariform larvae in feces or sputum. On careful examination of the stool specimen these forms were found, making a conclusive diagnosis of overwhelming strongyloidiasis. The Gram-negative bacillus present in the blood and sputum was *Klebsiella*. With appropriate antibiotic therapy and several days of thiabendazole treatment, his bacterial and parasitic infections resolved. Several months later, he has continued to do well, with no evidence of recurrent strongyloidiasis.

*Professor of Medicine, Department of Medicine, University of Washington School of Medicine.

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